

THE TAXONOMY OF THE *ATRAX ADELAISENSIS* SPECIES-GROUP
(MACROTHELINAЕ: MYGALOMORPHAЕ) WITH NOTES ON BURROWING BEHAVIOUR

by

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ABSTRACT

GRAY, M. R., 1982. The taxonomy of the *Atrax adelaidensis* species-group (Macrothelinae: Mygalomorphae) with notes on burrowing behaviour. *Rec. S. Aust. Mus.* 18 (19): 441-452.

The funnel web spiders, genus *Atrax*, making up the *adelaidensis* species-group from South Australia are described: *Atrax adelaidensis* sp. n., *A. eyrei* sp. n. and *A. flindersi* sp. n. Their distribution in relation to that of the genus is outlined. The absence of a serrula in all species and the distinctive modification of the first leg in males of *A. adelaidensis* are recorded. The unique burrow structure comprising shaft plus side-chamber with trapdoor is described and the presence of a surface door in early juvenile burrows is noted.

INTRODUCTION

Funnel web spiders (genus *Atrax* O. P. Cambridge, 1877) have a distribution that is essentially gondwanian. They are commonly represented in coastal and highland habitats from southern Queensland to Tasmania. North of the Gladstone area in southern Queensland records are available for three specimens only (all females), from Queensland, Papua New Guinea and the Solomon Islands respectively. These records have not been confirmed or added to since the original collections of 60 to 80 years ago and one of them definitely represents a locality data error: *Anaepsiada* (syn. *Atrax*) *ventricosa* Rainbow and Pulleine 1918 recorded from Cloncurry, northwest Queensland in fact was collected from Tamborine Mountain, southeast Queensland and is probably a juvenile *A. validus* Rainbow and Pulleine. In the drier conditions to the west of the Great Dividing Range their numbers fall off rapidly. To the west of the Grampian Range area in Victoria there appears to be a gap in the distribution of the genus until it reappears again in the highlands of the Mt. Lofty-southern Flinders Ranges and the southern Eyre Peninsula of South Australia (Fig. 32). These westernmost, isolated representatives of the genus *Atrax* form the *adelaidensis*-group.

NOTATION FOR SPINES

Leg surface abbreviations for spine counts: pd = prodorsal; rd = retrodorsal; pv = proventral; rv =

retroventral. The leg spination data given in the holotype and paratype descriptions refers to the range of variation encountered (total spine counts per surface) both in these specimens and the remaining type series; left and right side leg spine counts are included.

Atrax adelaidensis group

Diagnosis: Characteristic burrow with side chamber closed by trapdoor. Cephalic area moderately raised, serrula absent. Males lack apophysis on leg 2, sometimes with tibia and metatarsus of leg 1 swollen.

Comments: The presence of the *adelaidensis*-group was first reported by Main (1964) who then referred them to the genus *Hadronyche* L. Koch, 1872. Main (1967, 1976) also noted the burrow structure, including the presence of a side chamber closed by a trapdoor. Gray and Sutherland (1978) indicated that at least three species could be recognised and referred them to the genus *Atrax*, noting that their burrow structure set them apart from all other members of the genus. Their placement within *Atrax* is clearly indicated by the presence of three tooth rows in the fang groove, spinose tarsi and many cuspules on both the labium and maxillae.

The *adelaidensis* group shows two morphological features of particular interest. These are the absence of a serrula and the modification of the first legs in males of *A. adelaidensis*. In a survey of mygalomorph genera Platnick (1977) recorded the presence of a serrula in an unidentified species of funnel web spider. Examination of many eastern funnel web species by the present author indicates that serrula development in *Atrax* is highly variable—in some species the serrula is large and obvious, in others reduced or absent (Plates 5-7). The modification of the first leg in males of *A. adelaidensis* (Fig. 2) is most unusual for this genus. In other funnel web species it is the second leg that may show significant modification in the form of tibial and metatarsal apophyses. Not only the position but also the type of modification differs in *A. adelaidensis*, where the entire first metatarsus and tibia are swollen. A slight swelling of the second metatarsus is also evident.

This modification of the first leg may be of significance in the context of the generic relationships of

Atrax. The systematic position of the genus as a member of the family Dipluridae has long been problematical. Diplurid genera possessing male second leg modifications such as *Evagrus* Ausserer and *Allothele* Tucker are not closely related to *Atrax*. Simon (1892) used the presence of numerous cuspules on the labium and maxillae as key characters in his recognition of the genera *Atrax*, *Porrothele* Simon and *Macrothele* Ausserer in his Macrotheleae and Raven (1980) considers that these genera comprise a natural grouping within his Hexathelidae. Zoogeographically, as well as morphologically and behaviourally, the New Zealand genus *Porrothele* is a logical candidate for relationship with *Atrax*. Thickening of leg segments in these genera may be independent derivations but could be additional indicators of relationship.

The distribution limits of the *Adelaidensis* species are not clear as yet. However, the general areas of species distribution can be approximately defined as follows: *A. adelaidensis*—Mt. Lofty Range and adjacent coastal plain; *A. eyrei*—southern Eyre Peninsula; *A. flindersi*—southern Flinders Range (Fig. 32). These areas correspond with open forest habitats of the type best developed in the Mt. Lofty Range. In drier areas such as the Flinders Range the spiders tend to be concentrated in riparian habitats where open forest (though with a reduced understory) persists.

KEY TO FEMALES

1. Prodorsal surface of patella III with 18 to 26 spines. Pigmented lower lateral surface of abdomen marked with several paler bars *Atrax adelaidensis*
—Prodorsal surface of patella III with 6 to 9 spines. Lateral abdominal surface without pale bars 2
2. Abdominal pigmentation almost uniformly distributed, only slightly reduced laterally and ventrally. M.O.Q. length to posterior width ratio more than 1:2 *Atrax eyrei*
—Abdominal pigmentation concentrated dorsally and posteriorly, lateral and ventral surfaces much paler. M.O.Q. length to posterior width ratio less than 1:2 *Atrax flindersi*

KEY TO MALES

1. Tibia and metatarsus of leg 1 swollen. Tibia 1 with 2 ventral spines distally; metatarsus I with 25-30 ventral spines *Atrax adelaidensis*
—Leg 1 unmodified. Tibia 1 with 6-10 ventral spines; metatarsus I with 14-16 ventral spines *Atrax flindersi*

Atrax adelaidensis sp. n.

(Figs. 1-11, pl. 5)

Diagnosis: Prodorsal surface of patella III with 18 to 26 spines, 8 to 11 on patella IV. Female abdomen pigmented dorsally and laterally but three

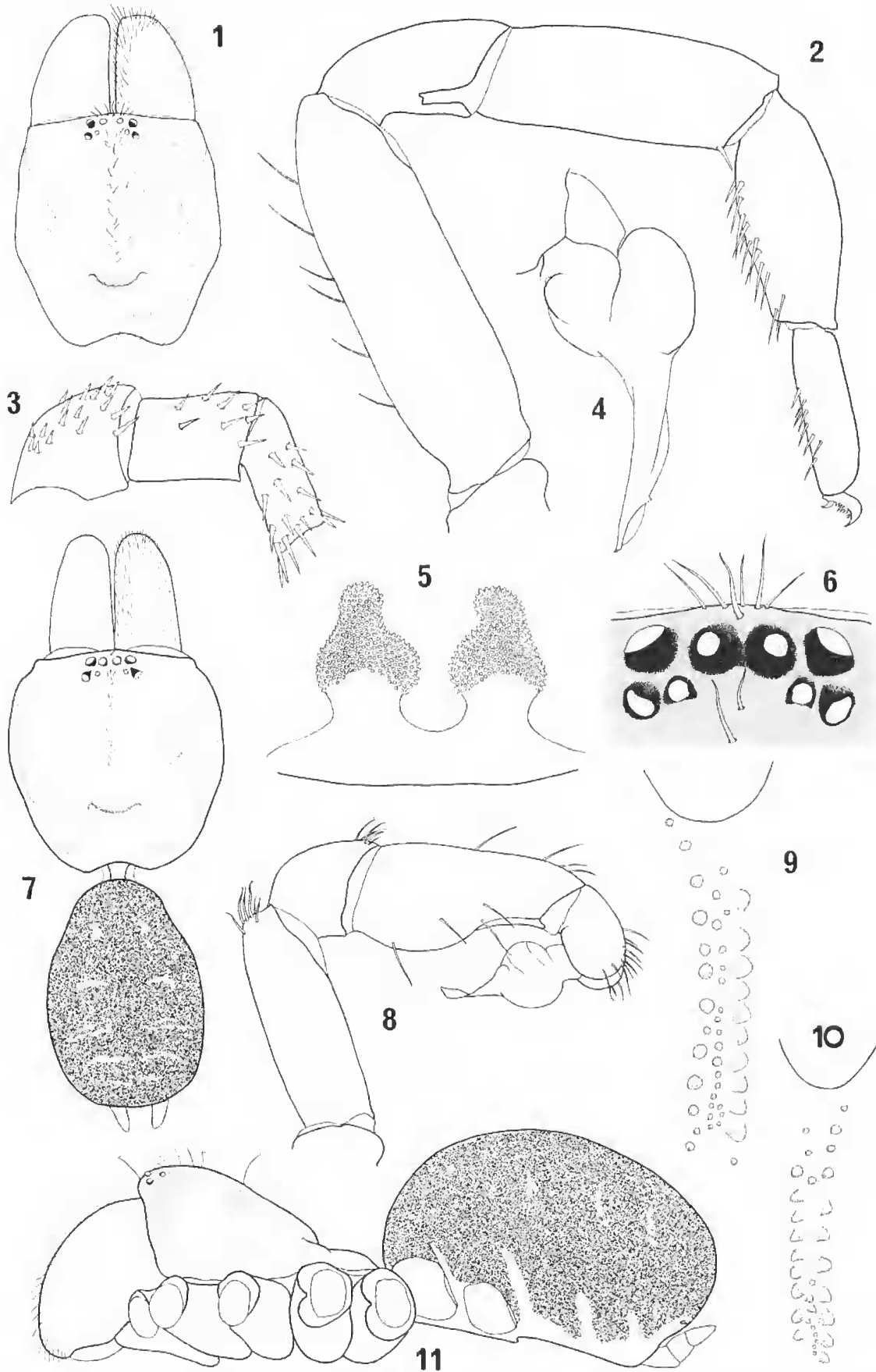
to five pale bars on lower lateral surface of abdomen; ventral abdomen pale. Tibia I and metatarsus I and II of males swollen. Male metatarsus I with 25-30 spines ventrally. Middle third of ventral fang groove with few or no teeth in male.

Female—HOLOTYPE N1979146

Measurements (mm) and markings: Total length (including chelicerae) 18.98, Carapace length 6.78; width 5.88; height 3.35. Abdomen length 9.30; width 6.40. Colour pattern—Carapace dark glossy brown-black, sparsely haired. Black pigment around eyes. Dorsal and lateral surfaces of abdomen dark maroon-brown. Ventrally and above the spinnerets pigmentation greatly reduced. Three to five pale bars extend from ventral surface up onto darkly pigmented lateral surface. Above spinnerets, small sector of pigmented cuticle cut off by narrow semi-circular band of non-pigmented cuticle. Abdominal cuticle finely rugose, depressed intervals between rugosities formed by numerous, small, non-pigmented, sub-circular to elongate depressions. Along dorso-lateral surfaces three pairs of pale markings, anterior pair roughly circular, posterior pairs thin, laterally elongated lines.

Cephalothorax: Eyes—Size (mm): AME 0.19, ALE 0.32, PLE 0.26, PME 0.17. Interdistances (mm): AME-AME 0.34, AME-ALE 0.24, ALE-PLP 0.23, PLE-PME 0.13, PME-PME 0.73, M.O.Q. length 0.51 mm; width, anterior 0.69 mm, posterior 0.91 mm. M.O.Q. length/posterior width ratio 1:1.78. Anterior eye row straight, width 1.67 mm. Posterior eye row recurved, width 1.68 mm. Carapace—longer than wide in ratio 1:0.87; raised in head region, height/length ratio 1:2.02. Fovea deep and strongly procurved, anterior margin smoothly curved. Chelicerae—inner margins of fang groove with 11 teeth (9 large) outer margin with 11 large teeth; centre of groove with 23 small teeth in single row, less regular apically and basally. Labium—wider than long in ratio 1.45:1, cuspules numerous. Maxillae—divergent with short, conical lobe apically. Cuspules numerous, few apically; serrula absent. Sternum—subcircular; length 3.81 mm, width 3.62 mm. Surface gently convex with thin cover of long and short hairs. Three pairs of sigilla, posterior pair large and oval, anterior pair very small, circular.

Legs: 4123. Length (mm): I 15.45; II 14.39; III 11.64; IV 15.57. Spination: I—metatarsus v 5-6, tarsus pv 3-8, rv 3-4, v 0-1; II—metatarsus p 1, v 5-7, tarsus pv 4-11, rv 3-5; III—patella pd 18-26, tibia p 7-8, t 2-3, metatarsus p 5-8, pd 2-4, rd 2-3, v 5-7, tarsus pv 10-13, rv 2-5; IV—patella pd 8-11, tibia p 2, metatarsus p 6-7, rd 0-2, v 6-7, tarsus pv 10-12. Trichobothria in single row on



FIGS. 1-11: *Atrax adelaidensis*. 1, Carapace, dorsal (female), x6; 2, Leg 1, retrolateral (male), x11; 3, Leg 3, prolateral (female): patella, tibia and metatarsus, x11; 4, Male copulatory organ, x20; 5, Female internal genitalia, dorsal, x20; 6, Eyes (female), x20; 7, Body, dorsal (male) x6; 8, Palp, prolateral (male), x6; 9, Tooth pattern in fang groove, left hand side (female), x20; 10, Tooth pattern in fang groove, right hand side (male), x20; 11, Body, side view (female), x6.

larsus, bothria collariform. Superior tarsal claws with three to six pectinations, inferior claw smooth. Tarsal scopulae absent. Tarsal organ distal to trichobothria, a low circular mound with faintly sculpted, concentric grooves.

Abdomen: Spinnerets—Posterior lateral spinnerets: length 2.35-2.58 mm; width 0.79-0.82; ratio of length of apical, middle and basal segment 2.2:1:1.6; basal separation 1.10 mm; terminal segment conical, longer than wide in ratio 1.95:1. Posterior median spinnerets: length 1.02; width 0.52 mm. Genitalia—a pair of spermathecae open ventrally into common copulatory bursa. Middle part of each spermatheca swollen.

Male—PARATYPE N1979145

Measurements (mm) and markings: Total length (including chelicerae) 16.1. Carapace length 5.92, width 5.58, height 2.71. Abdomen length 6.8, width 4.8. Colour pattern—similar to female except that the dorso-lateral abdominal markings more evident; lateral abdomen uniformly pigmented, no pale bars present.

Cephalothorax: Eyes—Size (mm): AME 0.23, ALE 0.32; PLE 0.23; PME 0.14. Interdistances (mm): AME-AME 0.17; AME-ALE 0.16; ALE-PLE 0.20, PLE-PME 0.11, PME-PME 0.69; M.O.Q. length 0.47 mm, anterior width 0.61 mm, posterior width 0.97 mm. M.O.Q. length/posterior width ratio 1:2.06. Anterior eye row slightly pro-curved, width 1.55 mm. Posterior eye row recurved, width 1.60 mm. Carapace—longer than wide in ratio 1:0.94. Raised in head region, height/length ratio 1:2.18. Chelicerae—inner margin of fang groove with 10-11 teeth (9 large); outer margin with 13 teeth (11-13 large); central groove with a row of 2-4 small teeth in apical third, none or reduced in central third, a row of 7-10 small teeth in basal third. Palp—distal prodorsal femur with 4-6 sinuous bristles; patella with 4-7 dorsal apical bristles. Embolic process of palpal bulb short and broad with well developed apical flange. Labium—wider than long in ratio 1:1.61, cuspules numerous. Sternum—length 3.63 mm, width 3.03 mm.

Legs: 1423 (or 4123). Length (mm): I 18.41 (19.30); II 17.55 (18.93); III 14.39 (15.35); IV 17.85 (19.60). Anterior legs modified, tibia I and metatarsus I swollen; metatarsus II weakly swollen. Tarsi weakly scopulate. Spination: I—tibia v 1-2, metatarsus p 0-2, v 25-30, tarsus pv 10-12, rv 7-11, v 0-2; II—femur d 0-1, patella r 0-1, tibia p 0-1, v 1-2, metatarsus p 0-1, r 0-2, v 12-16, tarsus pv 10-16, rv 6-11, v 0-1; III—patella pd 18-23, tibia pd 9-11, r 3, v 1-7, metatarsus p 8-13, pd 0-4, r

1-6, rd 2-5, v 8-14, tarsus p 12-16, r 0-2, rv 6-9, v 0-1; IV—femur d 4, patella pd 7-8, tibia p 2-3, r 2-4, d 1-2, v 2-4, metatarsus p 8, rd 1-2, v 8-12, tarsus p 14-17, rv 6-11, v 0-1. Single row of 3 to 5 weak bristles on dorsal surfaces of femora I, II, IV.

Abdomen: Spinnerets—posterior lateral spinnerets; length 2.60 mm; maximum width 0.56 mm; ratio of length of apical, middle and basal segments 1.55:1:1.79; basal separation 0.95 mm; apical segment conical, length/width ratio 2.82:1. Posterior median spinnerets; length 0.77 mm, width 0.31 mm.

Material examined: Holotype female (N1979146 S.A. Mus. coll.), Hackney, Adelaide, S.A. 16.11.1973, J. Batt; burrow in sloping, littered ground on banks of Torrens River. Paratype male (N1979145 S.A. Mus. coll.), St. Peters C.G.S., Adelaide, S.A. 3.6.1971, D. Edwards Paratype female (KS 4511 Aust. Mus. coll.), Beefacres Recreation Reserve, S.A., 16.11.1973, N. Miles; found in damp sandy soil under tree stump. Paratype male (KS 4512 Aust. Mus. coll.), Belair, Mt. Lofty Range, S.A. 24.5.1972. Two paratype males (N1979147, N1979148 S.A. Mus. coll.), Clare, S.A. 5.8.1979. Paratype female (N1979149 S.A. Mus. coll.), Rostrevor, Nt. Adelaide, S.A., May 1974, B. Brewer; in burrow, shaded alluvial soil by creek. Juvenile, Hahndorf, Mt. Lofty Range, S.A.

Atrax eyrei sp. n.

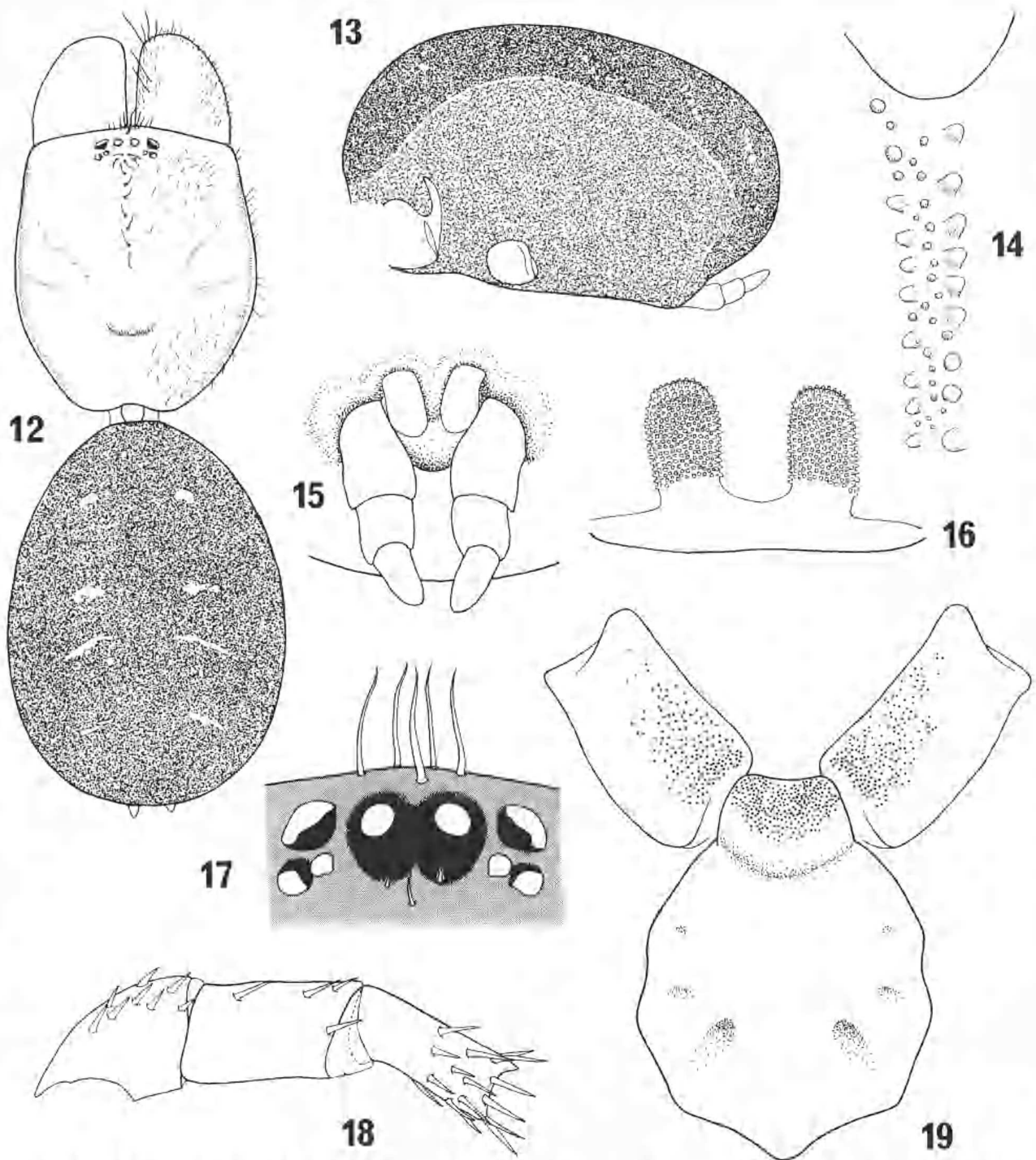
(Figs. 12-19)

Diagnosis: Prodorsal surface of patella III with 8 to 9 spines; 0 to 1 on patella IV. Abdominal pigmentation almost uniform, only slightly paler laterally and ventrally. Posterior median eyes widely separated; M.O.Q. length/posterior width ratio much greater than 1:2.

Female—HOLOTYPE KS 4509

Measurements (mm) and markings: Total length (including chelicerae) 18.14. Carapace length 6.62; width 5.93; height 3.38. Abdomen length 8.1; width 5.9. Colour pattern—Carapace dark, glossy brown-black, sparsely haired. Black pigment around eyes. Abdomen dark maroon-brown dorsolaterally, ventral surface only slightly paler. Abdominal cuticle finely rugose with small, subcircular to elongate nonpigmented depressions between rugosities. Dorsolateral abdominal surfaces with four pairs of non-pigmented markings, anterior pair sub-circular, remainder laterally elongate.

Cephalothorax: Eyes—Size (mm): AME 0.23, ALE 0.30, PLE 0.19, PME 0.13. Interdistances: AME-AME 0.28, AME-ALE 0.20, ALE-PLE 0.18, PLE-PME 0.06, PME-PME 0.91. M.O.Q. length 0.47, anterior width 0.71, posterior width 1.21. M.O.Q. length/posterior width ratio 1:2.57.

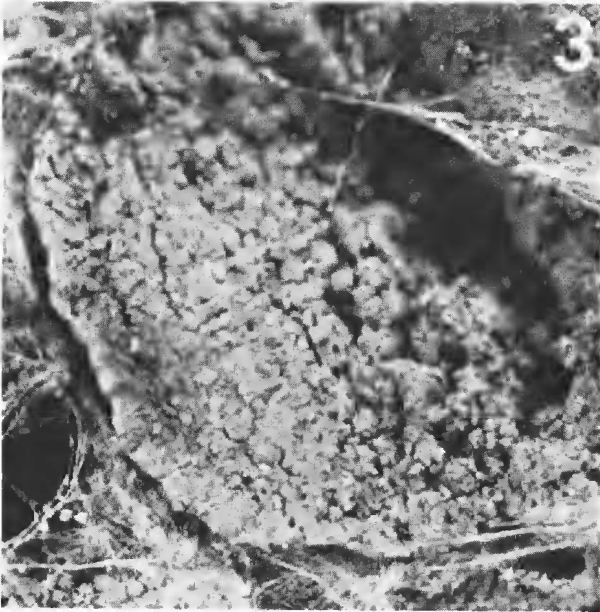


FIGS. 12-19: *Atrax eyrei*. 12, Body, dorsal (female), x6; 13, Abdomen, side view (female), x6; 14, Tooth pattern in fang groove, left hand side (female), x20; 15, Spinnerets, ventral (female), x20; 16, Female internal genitalia, dorsal, x20; 17, Eyes, dorsal (female), x20; 18, Leg 3, prolatateral (female): patella, tibia and metatarsus, x 11; 19, Maxillae, labium and sternum, ventral (female), x6.

Anterior eye row straight, width 1.62 mm; posterior eye row recurved, width 1.61 mm. Carapace—longer than wide in ratio 1:0.90; raised in head region, height/length ratio 1:1.96. Fovea procurved, anterior margin slightly indented on each side of midline. Chelicerae—inner margin of fang groove with 13-14 teeth (10 large), outer margin with 10 large teeth, central groove with 20-23 small teeth in irregular row. Labium—wider than long in ratio 1.45:1, numerous cuspules. Maxillae—divergent

with short conical lobe apically, serrula absent; cuspules numerous, few apically. Sternum—subcircular; length 3.90 mm, width 3.65 mm. Surface gently convex with thin covering of long and short hairs. Three pairs of sigillae, posterior pair large and oval, anterior pair very small, circular.

Legs: 4123. Length (mm): I 16.02; II 14.40; III 12.41; IV 16.03. Spination: I—metatarsus v 8, tarsus pv 3, rv 5, v 1; II—metatarsus p 0-1, v 9,



PLATES 1-4, *Atrax flindersi*. 1, open forest habitat, Mt. Remarkable, S.A.; 2, juvenile in feeding position, door standing open, silk trip lines radiating from burrow rim; 3-4, surface door of juvenile, 3, closed; 4, open.

tarsus pv 4-5, rv 4; III—patella pd 8-9, tibia p 4, r 1-2, metatarsus p 4-5, pd 2, rd 1-2, v 9, tarsus pv 8-9, rv 4; IV—patella pd 0-1, tibia p 1, metatarsus p 2, v 5-8, tarsus pv 7-9, rv 2. Trichobothria in single row on tarsus, bothria collariform. Superior tarsal claws with 5-6 pectinations, inferior claws smooth or with 1 pectination. Tarsal scopulae absent.

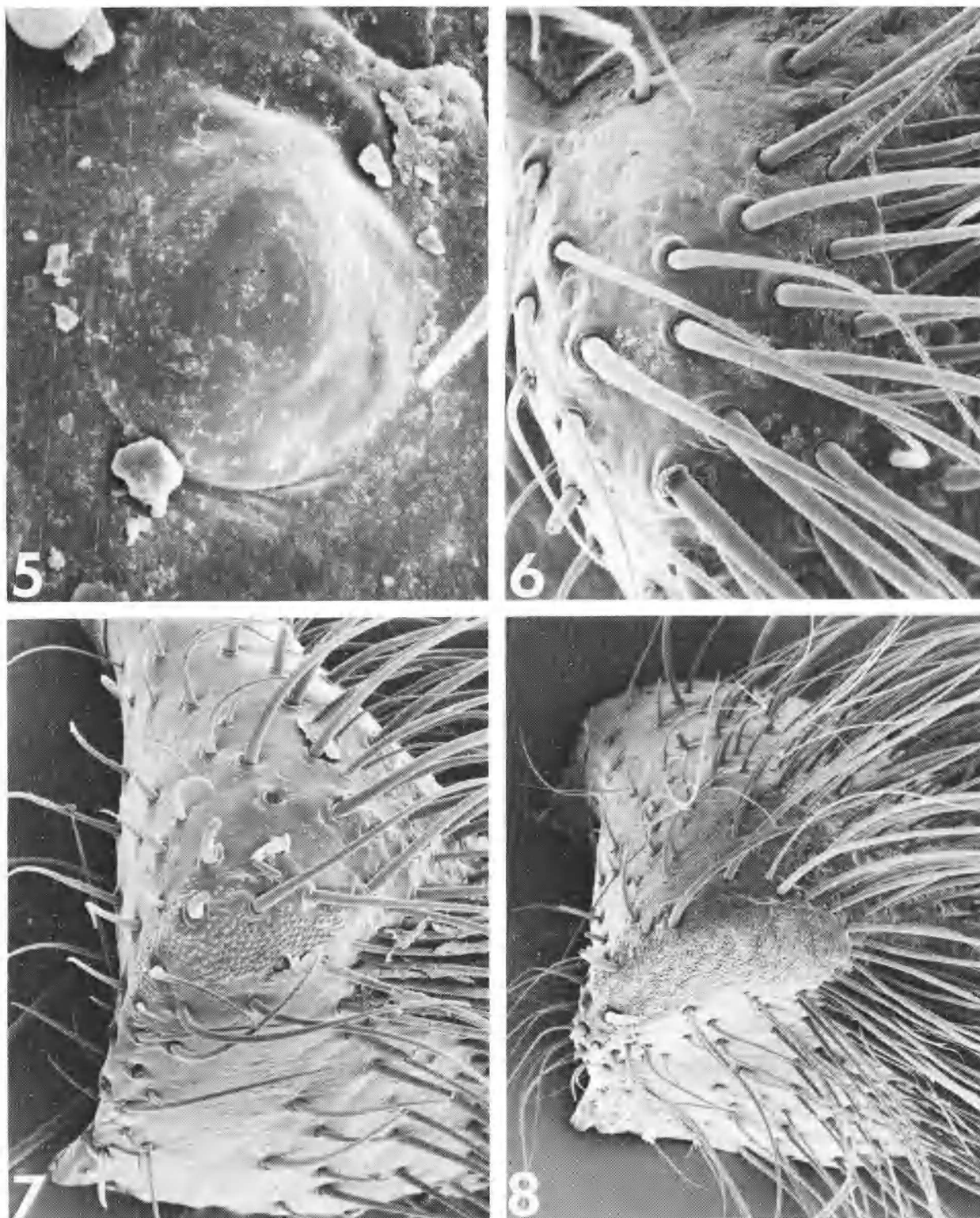
Abdomen: Spinnerets—posterior lateral spinnerets: length 2.67-2.72 mm; width 0.90-0.94 mm; ratio of length of apical, middle and basal segments 1.08:1:1.60; basal separation 1.30 mm; terminal segment conical, longer than wide in ratio 1.86:1. Posterior median spinnerets: length 0.94 mm; width 0.47 mm. Genitalia—pair of short, broad spermathecae opening ventrally into a common copulatory bursa.

Material examined: Holotype female (KS 4509 Aust. Mus. coll.), 6.5 km south of Coult, Eyre Peninsula, S.A. 18.12.1952. B. Y. Main (cat. no. 52/600). Paratype female (KS 4510 Aust. Mus. coll.), between Coult and Wangary, Eyre Peninsula, S.A., 18.12.1952. B. Y. Main (cat. no. 52/611). Juvenile male, Nr. Port Lincoln, Eyre Peninsula, S.A., 16.12.1952, B. Y. Main (cat. no. 52/540).

Atrax flindersi sp. n.

(Figs. 20-30, pls 1-4, 6)

Diagnosis: Prodorsal surface of patella III with 5 to 10 spines; 0 to 3 on patella IV. Abdominal pigmentation mainly dorsal; lateral and ventral surfaces paler. Femur I of male with 7-9 spines dorsally, femur II of male with 5-7. Tibia I of male with 6-10 ventral spines, tibia II of male with 8-10.



PLATES 5-8. 5, *Atrax adalaidensis*, tarsal organ, x1250. 6-8, apical lobe of maxilla showing serrula structure variation in three species of funnel web spider; 6, *A. flindersi* (serrula absent), x165; 7, *A. robustus*, x90; 8, *A. versutus*, x60.

Female—HOLOTYPE KS 983

Measurements (mm) and markings: Total length (including chelicerae) 20.02. Carapace length 6.90; width 6.12; height 3.37. Abdomen length 9.1; width 7.3. Colour pattern—carapace dark glossy brown-black, sparsely haired. Black pigment around eyes. Abdominal pigmentation dark maroon-brown dor-

sally, pigmented area narrow anteriorly, broader posteriorly. Lateral and ventral abdomen very lightly pigmented and tinged with pink. Abdomen cuticle finely rugose with small subcircular to elongate non-pigmented depressions between rugosities. Dorsal-lateral abdominal surfaces with four pairs of non-pigmented markings, anterior pair subcircular, remainder elongated and rather indistinct.

Cephalothorax: Eyes—Size (mm): AME 0.23, ALE 0.34, PLE 0.31, PME 0.18. Interdistances: AME-AME 0.27, AME-ALE 0.25, ALE-PLE 0.26, PLE-PME 0.11, PME-PME 0.78. M.O.Q. length 0.65, anterior width 0.67, posterior width 1.12. M.O.Q. length/posterior width ratio 1:1.72. Anterior eye row straight, width 1.65 mm; posterior eye row recurved, width 1.80 mm. Carapace—longer than wide in ratio 1:0.89; raised in head region, height/length ratio 1:2.01. Fovea deep and strongly procurved, anterior margin with broad shallow indentation centrally. Chelicerae—inner margin of fang groove with 14-16 teeth (12-15 large); outer margin with 15-18 teeth (12 large); central groove with 23-27 small teeth in irregular row, divided into two rows apically. Labium—wider than long in ratio 1.40:1, numerous cuspules. Maxillae—divergent, apically with short conical lobes, serrula absent; cuspules numerous, few apically. Sternum—subcircular to oval; length 4.04 mm, width 3.66 mm. Surface gently convex with thin covering of long and short hairs. Three pairs of sigilla, posterior pair large and oval. Anterior pair very small, circular.

Legs: 4123. Length (mm): I 16.33; II 14.93; III 13.36; IV 16.79. Spination: I—metatarsus v 7-9, tarsus pv 4-5, rv 5-6; II—metatarsus p 0-1, v 8-10, tarsus pv 4-5, rv 4-8; III—patella pd 5-10, tibia p 4, r 1-2, v 0-1, metatarsus p 2-5, pd 2-3, rd 2, v 7-10, tarsus pv 10-14, rv 4, v 0-1; IV—patella pd 0-2, tibia p 0-1, v 0-1, metatarsus p 1-4, rd 0-1, v 4-8, tarsus pv 6-15, rv 0-3. Superior tarsal claws 5-7 pectinations, inferior claws smooth. Tarsal scopulae absent. Tarsal organ distal to trichobothria, low circular mound with faint concentric grooves.

Abdomen: Spinnerets—posterior lateral spinnerets; length 3.53 mm; width 1.02 mm; ratio of length of apical, middle and basal segments 1.78:1:1.62; basal separation 1.48 mm; terminal segment conical, longer than wide in ratio 2.56:1. Posterior median spinnerets: length 0.94 mm, width 0.47 mm. Genitalia—a pair of rather slender spermathecae, terminally swollen, opening ventrally into common copulatory bursa.

Male—PARATYPE KS 980

Measurements (mm) and markings: Total length (including chelicerae) 16.80. Carapace length 6.23; width 6.29; height 3.06. Abdomen length 7.50; width 5.70. Colour pattern—as for female; paired abdominal markings slightly more emphatic.

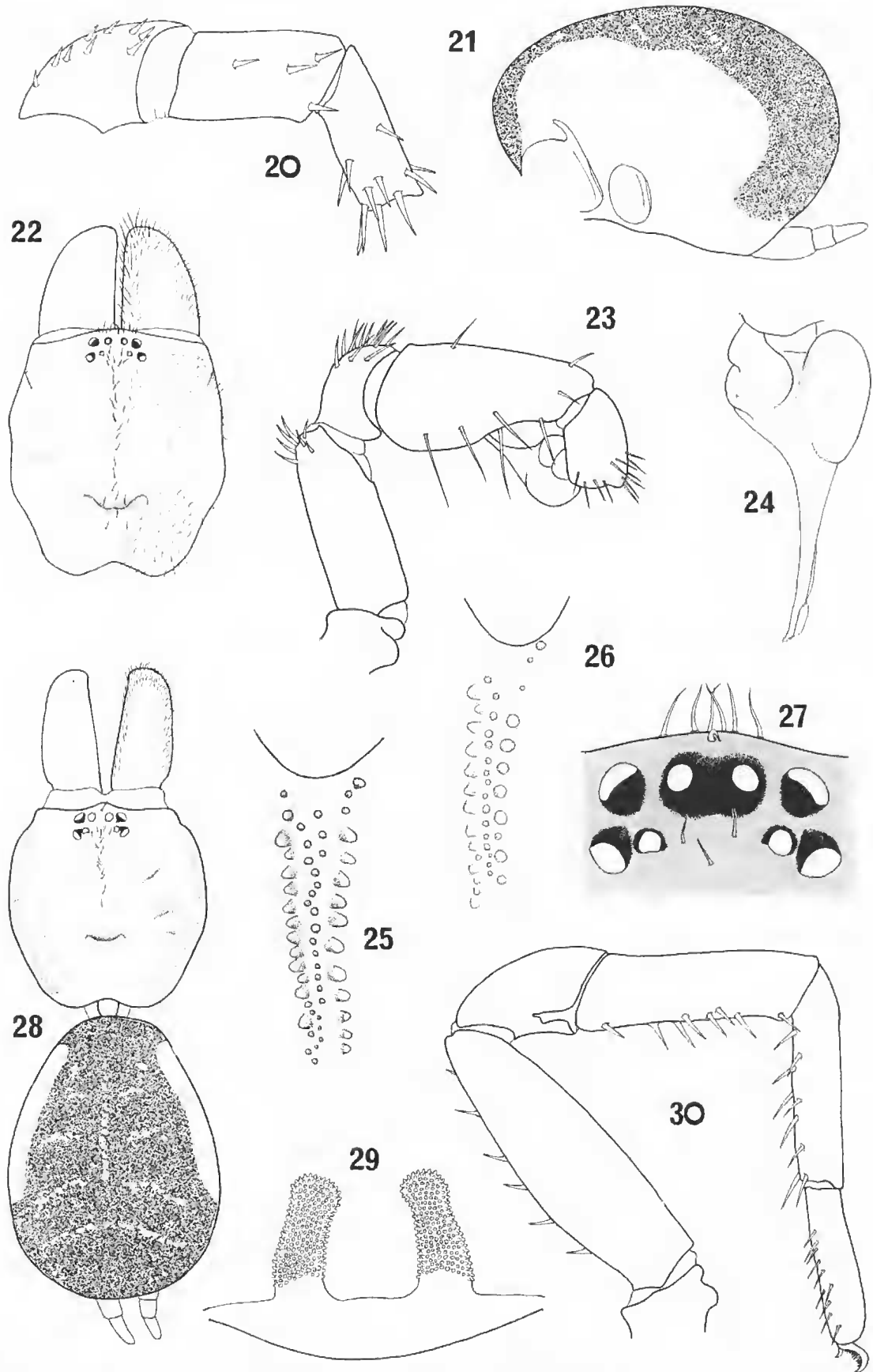
Cephalothorax: Eyes—Size (mm): AME 0.26, ALE 0.35, PLE 0.23, PME 0.15. Interdistances (mm): AME-AME 0.26, AME-ALE 0.12, ALE-PLE 0.24, PLE-PME 0.12, PME-PME 0.82. M.O.Q. length 0.58, anterior width 0.74, posterior

width 1.18. M.O.Q. length/posterior width ratio 1:2.03. Anterior eye row straight, width 1.59 mm. Posterior eye row recurved, width 1.64 mm. Carapace—slightly wider than long in ratio 1:0.99. Raised in head region, height/length ratio 1:2.04. Fovea deep, procurved, anterior margin smoothly curved. Chelicerae—inner margin of fang groove with 12 teeth (10-12 large), outer margin with 14-15 teeth (12-13 large), central groove with 18-19 small teeth in single row. Palp—femur with 7 prodorsal, apical spines; patella with 14 dorsal, apical spines. Embolic process of palpal bulb straight and slender with well developed apical flange. Labium—wider than long in ratio 1.54:1. Sternum—subcircular; length 3.46 mm; width 3.26 mm. Sigillae as in female but placed closer to lateral margins and anterior sigilla much more distinct.

Legs: 4123. Length (mm): I 19.46; II 18.24; III 17.82; IV 21.39. First and second legs unmodified. Tarsi of legs III and IV mildly swollen. Tarsal scopulae present, strongly developed on legs II, III and IV. Spination: I—femur p 0-2, d 7-9, tibia p 0-1, v 6-10, metatarsus p 0-2, v 12-15, tarsus pv 8-9, rv 9-12, v 1-3; II—femur d 5-7, tibia v 8-10, metatarsus v 12-13, tarsus pv 9-10, rv 8-10, v 0-1; III—femur d 0-1, patella pd 5-8, tibia p 4-7, r 1-4, d 1-4, d 1, v 4-6, metatarsus p 2-8; r 2-3, rd 2-3, v 11-15, tarsus p 8-12 r 0-2, rv 8-14; IV—femur d 5-6, patella p 0-3, tibia p 1-4, r 3-5, d 0-3, v 4-6, metatarsus p 3-5, re 0-2, v 11-15, tarsus p 9-15, rv 8-11.

Abdomen: Spinnerets—Posterior lateral spinnerets: length 3.30 mm; width 0.71 mm; ratio of length of apical, middle and basal segments 1.12:1:1.24; basal separation 1.40 mm; terminal segment a slender cone, longer than wide in ratio 3.49:1. Posterior median spinnerets cylindrical; length 0.91 mm, width 0.36 mm.

Material examined: Holotype female (KS 983 Aust. Mus. coll.), Mt. Remarkable (lower slopes), 3 km north of Melrose, Flinders Range, S.A., 23.4.1973, M. and G. Gray. Dry open and eucalypt forest, burrow with side passage in littered riparian slope; juveniles in side passage. Paratype male (KS 980 Aust. Mus. coll.), Mt. Remarkable (lower slopes), 3 km north of Melrose, Flinders Range, S.A., 25.4.1973, M. and G. Gray; pitfall trap in dry open forest on southern eastern slope. Paratype males (KS 979 and KS 985 Aust. Mus. coll.) and female (KS 981 Aust. Mus. coll.), Mt. Remarkable (lower slopes), 3 km north of Melrose, Flinders Range, S.A., March-April 1973, M. and G. Gray; dry open eucalypt forest, sloping ground with medium-heavy litter cover.



FIGS. 20-30: *Atrax flindersi*. 20, Leg 3, prolateral (female): patella, tibia and metatarsus, x11; 21, Abdomen, side view (female), x6; 22, Carapace, dorsal (female), x6; 23, Palp, prolateral (male), x11; 24, Male copulatory organ, x20; 25, Tooth pattern in fang groove, right hand side (female), x20; 26, Tooth pattern in fang groove, right hand side (male), x20; 27, Eyes, dorsal (female), x20; 28, Body, dorsal (male), x6; 29, Female internal genitalia, dorsal, x20; 30, Leg 1, retrolateral (male), x11.

BEHAVIOURAL OBSERVATIONS ON *ATRAX FLINDERSI*

Field observations

Summer collections of *A. flindersi* were made on riparian slopes in the summer-dry, open eucalypt forest habitats of the Mt. Remarkable area (Plate 1). The retreat is a ground-burrow consisting of a main shaft plus a side chamber closed by a door (Fig. 31). The burrow has a single entrance which is hidden amongst the well-developed litter layer of the forest floor. The burrow may be sited in an open situation or in the shelter of a grass tussock, log or stump. This retreat structure contrasts markedly with that typical of many eastern members of the genus occupying wetter forest habitats (Gray 1978).

The entrance to the adult burrow consists of a silk collar which in *A. flindersi* is produced around one side to form a short cowl-like structure which lies limply across the entrance partially occluding it. The silk of both collar and cowl is well disguised by attached litter and fine soil particles.

The silk lining of the main shaft is entire and closely adherent to the soil walls. Total burrow depth varied from 21 to 25 mm; burrow diameter varied from 1-1.5 cm near the entrance to 2-2.5 cm in the end chamber. The general inclination of the burrow is at 90° to the ground slope, though the end chamber below the level of the side chamber may be less steeply inclined.

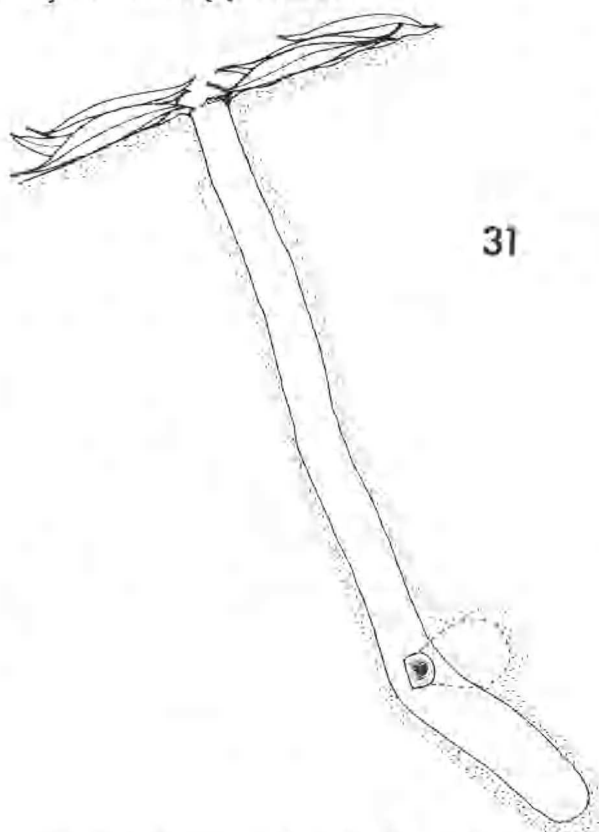


FIG. 31. Burrow structure of *Atrax flindersi*

The silk-lined, flask-shaped side chamber (length 3-4.5 cm; width 2-2.5 cm in adult burrows) was placed between three-quarters and four-fifths of the way down the burrow of adult specimens. In the burrows of juveniles the side chamber may be only half-way or even less down the burrow. The side chamber is closed by a strong, externally concave, soil trapdoor, hinged vertically (diameter 0.85-1.5 cm in adult burrows). The usual orientation of the side chamber was slightly upslope, but this was not invariable. A shallow excavation in the wall of the main shaft at the level of the trapdoor probably provides space for manoeuvring during door opening operations.

The functions of the side chamber seem mainly concerned with the provision of a secure refuge against predators, particularly when moulting, and a protective brood chamber for the eggs and spiderlings. Several *Atrax* burrows were found to contain occupants which could represent predators—a centipede, a large carabid beetle and a spider—the latter belonged to the genus *Aname* and was found with the remains of the presumed original occupant. One burrow contained a brood of 21 spiderlings in the side chamber. The need to function as a brood chamber during the hot summer months could account for the trend suggesting that adult side chambers are found at greater depths relative to total burrow depth than those of juveniles; brood chamber function would require long term constancy of high humidity—moderate temperature conditions which would not be so critical for the temporary predator/moulting refuge function which must be the primary role of the shallower side chamber of juvenile burrows.

Morphological adaptations to aridity are not readily apparent in any of the *adelaidensis* species. Consequently, in summer-drought regions such as the Flinders Range the construction of a relatively deep, vertical ground burrow has obvious advantages in avoiding desiccation and overheating. Soil characteristics may also be significant, particularly in relation to their water-holding ability which directly influences soil and burrow air-water humidity. The burrows of *A. flindersi* were excavated in a yellow-grey, gritty loam. Evidence from trapdoor spider burrow studies indicates that such soil would require severe surface drying conditions to render the soil air significantly undersaturated below 10 cm from the surface (Gray 1969). The surface litter cover would provide a further cushioning effect against environmental drying.

Laboratory observations

Fifteen juveniles (probably second instar) taken from the side chamber of a burrow in the Mt. Remarkable area were set up individually in glass jars with 10 cm depth of lightly littered soil. All

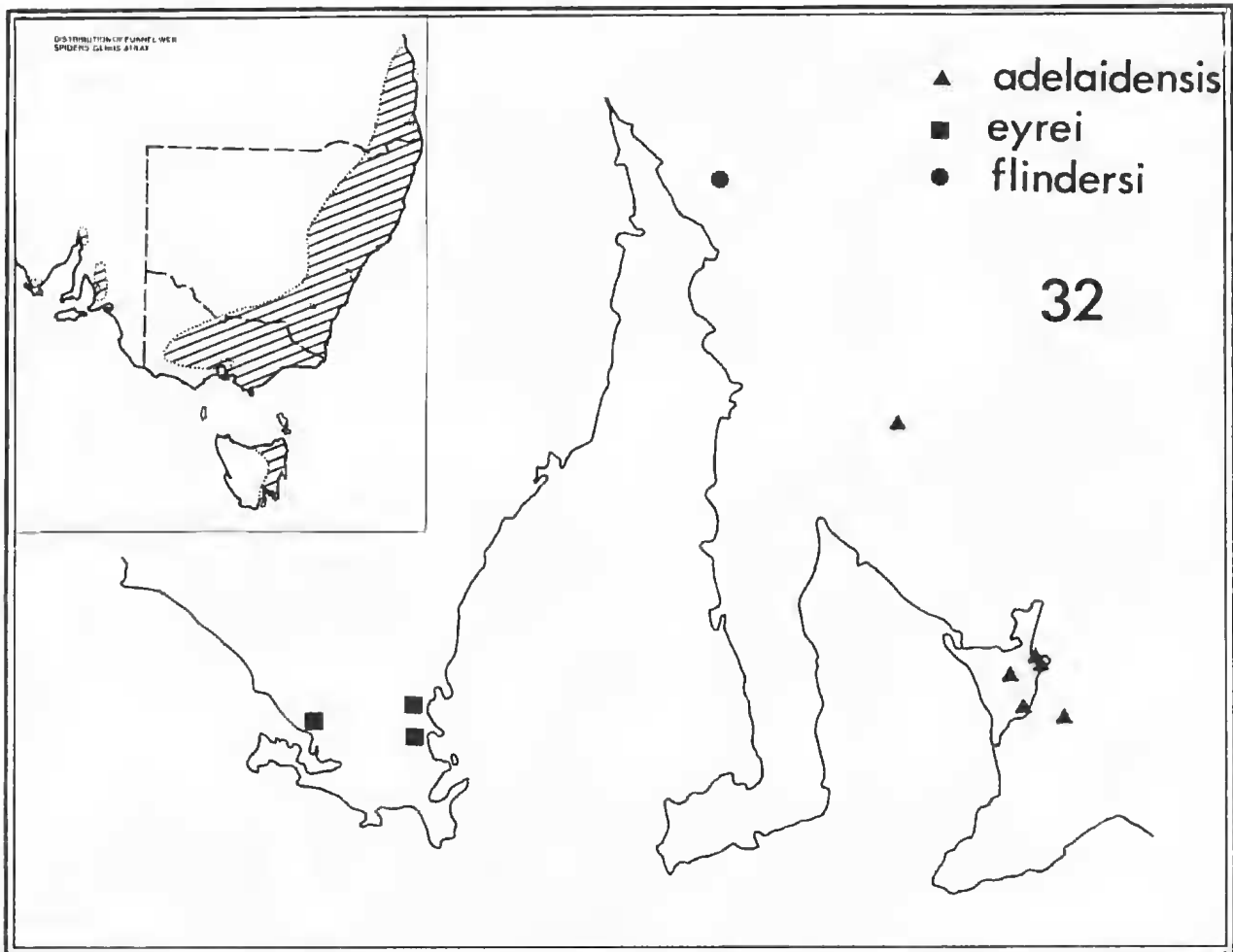


FIG. 32. Distribution records for the *Atrax adalaidensis* species-group in South Australia. Inset—overall distribution of the genus *Atrax*.

juveniles excavated small burrows and twelve of them constructed flap-like, but quite rigid, soil trapdoors closing the surface burrow entrances (Plate 2, 3). The remainder constructed an indefinite soil-silk entrance mound. When hunting, the juveniles would prop the door wide open at an angle of 70-100° and sit in the burrow mouth with the tarsi of the palps and first two pairs of legs resting on the burrow rim (Plate 4). Some sheet-like silk was placed on the ground around the burrow entrance, usually radiating outwards as prey trip-lines. In catching prey the spiderlings were seen to fully emerge from the burrow up to a distance of 2 cm. Examination of these burrows revealed that no side chamber was present, the burrow consisting of a simple, vertical shaft. The discovery of surface door building behaviour in *A. flindersi* spiderlings is interesting in view of its absence in the adults and larger juveniles. However, in the context of the environmental conditions that the juveniles face, adaptive advantages can be seen. The major advantages would seem to be that the microclimate within a shallow burrow closed by a surface door is likely

to be more stable than that found within an open or partially closed burrow; and in the absence of a side chamber refuge, the surface door may serve to decrease predation on spiderlings. The burrows of larger juvenile spiders kept in captivity showed no sign of a surface door, a mixture of soil and silk usually partially closing the entrance leaving only a small opening to one side or none at all. A side chamber with door was always present in these burrows.

The initial stages of burrowing activity by some of these juveniles were observed. The litter adjacent to the burrow site was silked together and drawn inwards. The soil surface to be excavated was thinly silked over, a process repeated with each phase of digging, and the chelicerae used to loosen the soil. Both chelicerae and palps combined to scrape up and carry away the soil as silk-impregnated bundles which were initially deposited (and tamped down by the palps) just outside the burrow lip. Frequent 360° traverses were made with the spinnerets about the lip area of the burrow so building up a soil-impregnated silk collar attached to the surrounding

litter. This collar was periodically raised slightly by the palps and first legs and the whole jerked in centrally.

At this stage a shallow inclined burrow approximately 2 cm deep and 1.5 cm wide had been excavated. A second opening or "window", about half the size of the original entrance, was then made in the thin roof of the burrow; this "window" apparently provided room for manoeuvring while excavating the bottom of the burrow, the spider's abdomen being protruded out of it during turning and digging operations. Subsequent activity took place entirely within the burrow. Soil was progressively added to the internal margins of both entrance and window until the latter was completely closed over. The entrance was eventually reduced to a small irregular hole 2-3 mm wide

located near the lower edge of the original entrance. This location arose because the direction of deposition of soil proceeded from the upper toward the lower margin of the entrance. The soil-impregnated silk curtain so formed over the burrow entrance can be seen to have affinities both with the cowl-like entrance structure noted in the field situation and the soil door built by captive second instar juveniles.

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